

wrapped around the conducting fibre. The conductive fibre is, thus, recessed below the general profile of the surface of the yarn.

[0071] A portion of a further alternative position sensor **1001** is shown in cross-section in **FIG. 10**. A central layer **1002** separates the outer layers **201** and **202**, which are of the type described with respect to **FIGS. 2 and 3**. The central layer is a felted (non-woven) fabric comprising of a mixture of conductive and insulating fibres. The conductive fibres are manufactured to be shorter than the thickness of the central layer and therefore none of the conductive fibres extend completely through the central layer. Furthermore, the ratio of conductive to non-conductive fibres is such that there is no conductive path through the thickness of central layer, or along the central layer, when it is not compressed. Therefore, at locations where no external force is applied to the sensor and the central layer is not compressed, some conductive fibres in the central layer may be in contact with the outer layer but no conductive path exists between the outer layers.

[0072] At location **1003**, the sensor is compressed by an externally applied force indicated by arrow **1004**. The force brings the three layers into intimate contact and conductive fibres in the central layer make electrical contact with the outer conductive layers. In addition, the conductive fibres within the central layer come into contact with other such fibres and thus a conductive path is formed through the central layer between the two outer layers. Furthermore, as the force is increased, the layer is further compressed, the conductive fibres make further connections with other such fibres and the resistance between the outer layers is decreased.

[0073] At location **1005** the sensor is folded and produces a localised region of conductivity within the central layer close to its inner surface **1006**. However, the region of conductivity does not extend through the layer **1002** and so a conductive path is not formed.

[0074] This configuration provides a position sensor for detecting the position of an applied mechanical interaction where the mechanical interaction has an area and a force. The arrangement includes a first fabric layer **201** having conductive fibres machined therein to provide a first conductive outer layer. In addition, there is provided a second fabric layer **202** having conductive fibres machined therein to provide a second conductive outer layer. A single inner layer **1002** is provided disposed between the first fabric layer and the second fabric layer. The inner layer comprises a plurality of conductive fibres or particles such that a conductive path is provided through the fibres or particles when the insulating material is placed in compression.

[0075] A portion of a further alternative position sensor **1101** is shown in cross-section in **FIG. 11**. A central layer **1102** separates the outer layers **201** and **202**, which are of the type described with respect to **FIGS. 2 and 3**. The central layer **1102** consists of conductive filaments interspersed within a compressible elastomeric compound. In the present embodiment the elastomeric compound is a silicone rubber compound. The conductive filaments are sufficiently short such that they cannot extend across the thickness of the layer and the density of the filaments within the silicone compound is such that they generally do not connect with each other. However, when the layer is compressed the fibres

within the central layer increasingly come into contact with other such fibres and form a localised conductive region. Therefore at position **1103** an applied force indicated by arrow **1104** compresses the layers **201**, **202** and **1102** and the conductive fibres within the central layer **1102** provide a conductive path between the outer conductive layers.

[0076] The sensitivity of sensors such as sensor **1101** is determined by the density of fibres within the silicone compound and the compressibility of the silicone compound.

[0077] In an alternative embodiment the short filaments within central layer **1102** are replaced by conductive particles such as nickel powder.

[0078] A portion of a further alternative position sensor **1201** is shown in cross-section in **FIG. 12**. A central layer **1202** separates the outer layers **201** and **202**, which are of the type described with respect to **FIGS. 2 and 3**. Central layer **1202** is constructed from fabric (but alternatively it may be another deformable material) and has recessed electrically conductive elements **1203** continuing through the thickness of the layer **1202**, together with a raised non-conductive element **1204**. Therefore, at locations where no external forces are applied, the raised non-conductive element **1204** provides an insulating separating means between each of the outer layers and the conductive elements **1203**. Conductive elements **1203** are electrically isolated from each other by the non-conductive element **1204** and thus layer **1202** is not conductive along the layer in any direction. The non-conductive element **1204** is formed from fabric having open spaces corresponding to conductive elements **1203** with printed conductive material such as elastomeric conductive polymer forming the conductive elements **1203**. The conductive material is chosen in this case to be relatively incompressible and it therefore has a resistivity which is relatively stable under varying applied pressure.

[0079] At position **1205** the sensor is compressed by an externally applied force indicated by arrow **1206**. A number of the conductive elements are brought into contact with both of the outer layers and so provide a conductive path between the outer layers. An increase in the applied force produces only a relatively small change in the resistance between the two outer layers because of the incompressible nature of the conductive elements. However, as the area over which the force acts increases, the number of conductive elements that provide a conductive path between the outer layers also increases. Therefore, the resistance between the outer layers decreases as the area of mechanical interaction increases but it is relatively unaffected by changes in force.

[0080] A further alternative embodiment of the present invention is shown in cross-section in **FIG. 13**. A sensor **1301** comprises outer layer **201** and **202** of the type described with reference to **FIGS. 2 and 3**, separated by a central fabric layer **1302**. The conductive outer layers **201** and **202** are attached by arrays of electrically non-conducting adhesive dots **601** and **602** to the central layer **1302**. The adhesive dots **601** and **602** are of the type previously described with reference to **FIG. 6**. The central layer is manufactured by printing an electrically conductive printable material, such as a conductive ink, onto insulating fabric **1303** having an open weave structure, to produce an array of dots. (Alternatively a knitted fabric, or a non-woven fabric may be used in place of the open structured weave.)